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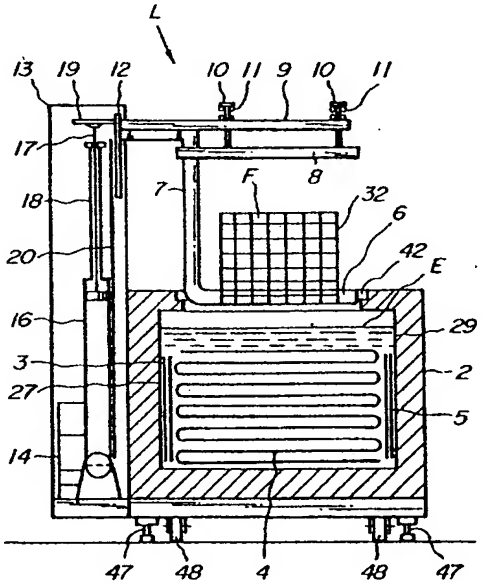
(54) Method for freezing foods and freezer thereof.

(57) The present invention is a method for producing refreshable frozen foods such as meat and other food (F) suitable for freezing foods by dipping foods in an agitating jet flow of a liquid anti-freezing medium (E) such as ethyl alcohol under controlling between -30°C and -50°C so as to have refreshable foods to restore it to an original fresh raw state by defrosting, and a super rapid freezer thereof.

FIG_1



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The present invention relates to a method for producing refreshable frozen foods suitable for freezing foods in a liquid anti-freezing medium so as to have refreshable foods to restore it to an original fresh raw state by defrosting, and a super rapid freezer thereof.

A cold air has hitherto been used as a cold medium for freezing and preserving foods such as edible meats, fish and vegetables and the like, and a freezing system with the cold air or nitrogen gas has been used.

The prior method for freezing edible meat and the freezer thereof, as shown in Fig. 11, are of a freezing system with a cold air by housing a food F within a freezing sealed chamber 1, and spraying a cold air N to the food F in the direction of an arrow.

According to this system, in case of edible meat, there are such disadvantages that the condition of frozen meat is worse, drippings are produced when defrosting, the component of meat is flowed out together with blood, thereby the taste as edible meat is lowered. Moreover, food is frozen by a cold air flow at super low temperature such as -20 °C to -40 °C, so that uneven freezing is produced at the deep side, side surface, bottom portion and the like of a food where a cold air flow cannot directly be made into contact with.

Freezing quality of a food depends upon how quick the food is passed through the maximum freezing forming zone (i.e. -1 °C to -10 °C) of a food to be frozen.

A frozen crystal of water in frozen meat largely breaks cells at slow freezing, and as a result, dripping is liable to cause and the components of meat which keeps freshness and flavor are lost at the time of defrosting and the degree of freshness and the flavors are deteriorated, and the decomposition is accelerated by adhering many various germs to the meat.

Japanese Patent Application Laid-open No. 3,736/87 discloses a process for quickly freezing sea food, comprising an agitating shaft, freezing piping and a basket for housing meat of sea food within a tank, a motor and a compressor provided outside the tank, thereby cooling brine adding rape oil to a solution consisting of propylene glycol, potassium chloride and water, and immersing and freezing sea food in said brine, and such freezing process has been known.

The present invention aims to obviate the shortcoming of the prior art and to provide a method for freezing foods at super rapid freezing rate and a freezer thereof by accurately controlling freezing temperature of -30 °C to -50 °C and freeze-dipping time of foods of 30~120 minutes freezing within a short time, maintaining and hot lowering quality, freshness, taste, and flavors of frozen foods, more specially frozen meat after defrosting.

A object of the present invention is to provide, a method for freezing foods according to the present invention comprises the steps of uniformly cooling an anti-freeze medium of an aqueous solution of ethyl alcohol of a secondary cooling medium by a stainless steel freezing coil tube circulating the first cooling medium and provided within a sealed anti-freeze medium tank, jet-agitating this cooled anti-freeze medium by a jet-agitator, dipping foods in an agitating jet flow of this cooled anti-freeze medium, controlling a temperature of said cooling medium within -30 °C to -50 °C by a temperature sensor, and uniformly freezing the foods at a super rapid freezing rate.

Another object of the present invention is to provide a super rapid food freezer comprising an anti-freeze medium tank filled with an anti-freeze medium, a freezing coil tube made of stainless steel and disposed in the vertical direction along at least three inner wall surface of said tank, a jet-agitator provided in another inner wall surface of said tank together with temperature sensor, a food lifting device provided at the upper portion of said tank, a sealed heat insulating lid resiliently supported by the lifting device, wherein an opening portion of said tank is airtightly closed or opened by the sealed heat insulating lid, and the food is also freely dipping in or out of the anti-freeze medium of the tank and the food uniformly frozen at a super rapid cooling rate by dipping into said anti-freeze medium. The super rapid food freezer is further comprising a jet tube having a jet inlet and a jet outlet of an anti-freeze medium, a jet screw type jet-agitator provided with a screw in the jet tube, so as to jet-agitate the cooled anti-freeze medium, and to guide the jet flow by a jet guiding tilting plate provided at the jet outlet for jetting the anti-freeze medium in the jet agitator. Said food freezer further comprising a basket for housing food on a stainless steel backing perforated plate supported by a lifting frame of lifting device, a hydraulic cylinder device for actuating lifting device, a sealed insulating lid resiliently supported by a supporting arm fixed to the lifting frame, whereby the opening portion of the tank is freely closed air tightly or opened by said lid. The super rapid food freezer is further comprising a food lifting device for freely dipping or taking out the food from the anti-freeze medium of the tank.

An object of the present invention is to provide a freezing method for obtaining frozen edible or refreshable meat or the food which is uniformly frozen at a super rapid cooling rate within a short time or easily defrosted by regulating a temperature of an anti-freeze medium by a temperature sensor, uniformly

cooling the anti-freeze by a freezing coil tube, and dipping the refreshable meat or the food in the cooled anti-freeze jet flow circulated within a anti-freeze medium tank.

Another object of the present invention is to provide a freezer which is able to uniformly cool and anti-freeze medium by the aid of a freezing coil tube arranged vertically along the inner wall of an anti-freeze medium tank, and to cool the anti-freeze medium by a jet of a jet-agitator, and to uniformly freeze the refreshable meat or the food at a predetermined temperature with good freezing efficiency. Further object of the present invention is to provide a freezer in which the refreshable meat or food can easily be taken out by housing a meat or food to be frozen in a basket, placing the basket on a perforated backing plate or a lifting frame of a food lifting device, lowering the lifting frame by operating a control device, easily dipping the food in an anti-freeze medium, closing and sealing an opening portion of an anti-freeze medium tank by a sealed heat insulating lid, completing freezing, and raising the lifting frame.

For a better understanding of the invention, reference is made to the accompanying drawing, in which:

Fig. 1 is a side view of a freezer removing a control device, a jet agitator and a temperature sensor;

Fig. 2 is a front view of the freezer;

Fig. 3 is a plan view of Fig. 2;

Fig. 4 is a cross-sectional top view of a freezing tank filled with anti-freezing medium for showing freezing coil tubes;

Fig. 5 is a cross-sectional front view for showing a jet-agitator;

Fig. 6 is a cross-sectional side view for showing a jet-agitator and a temperature sensor;

Fig. 7 is a schematic diagram of pipeline of a freezer;

Fig. 8 is an explanatory view showing the jet flow agitating condition of a jet screw pump;

Fig. 9 is an explanatory view of another embodiment showing the jet flow agitating condition of the jet screw pump;

Fig. 10 is an explanatory view showing the liquid freezing condition of the present invention; and

Fig. 11 is an explanatory view of a cold air freezing method and its freezer showing the freezing condition by cold air in the prior art.

Throughout different figures of the drawing, 1 is an air tightly sealed freezing chamber, 2 is a tank filled an anti-freeze medium, 3, 4 and 5 are a freezing coil tube, 6 is a stainless steel backing perforated plate, 7 is a lifting frame, 8 is a sealed heat insulating lid, 9 is a supporting arm, 10 is a screw rod, 11 is a spring, 12 is a lifting plate, 13 is an oil pressure cylinder chamber, 14 is a motor of oil pressure cylinder, 16 is an oil pressure cylinder device, 17 is a piston rod, 18 is a telescopic tube, 19 is a connection body, 20 is a guiding axis, 21 is a screw, 22 is a screw axis, 23 is a jet flow tube, 24 is an inlet of jet flow, 25 is an outlet of jet flow, 26 is a jet flow guiding tilted plate, 27, 28, 29, 30 are an inner wall of anti-freeze medium tank, 31 is a heat insulating layer, 32 is a basket, 33 is a jet-agitator, 34 is a control device, 35 is a switching button, 36 is a freezing compressor, 37 is a jet flow agitator and a temperature sensor chamber, 38 is a temperature sensor, 39 is a strainer, 40, 41 are a pressure valves, 42 is an opening portion of the anti-freeze medium tank, 43 is a defect portion of sealed heat insulating lid, 44 is an opening of oil pressure cylinder device chamber, 45 is a motor for screw, 46 is a motor supporting cylindrical frame, 47 is a die stand, 48 is a die wheel, C is a compressor unit, E is an anti-freeze medium, F is a food to be frozen, H is a header, L is a food lifting device, N is a cooled air, P is a freezing medium path and V is a valve.

The invention will now be described in further detail by referring to a preferred embodiment thereof which is schematically shown in the accompanying drawings.

A method for freezing foods according to the invention is characterized in that an anti-freeze medium (i.e. brine) E of an ethyl alcohol aqueous solution of a secondary cold medium is uniformly cooled by stainless steel freezing coil tubes 3, 4 and 5 within a sealed anti-freeze medium tank 2, the thus cooled anti-freeze medium E is agitated by jet flow of a jet-agitator 33, a food F is dipped in an agitating jet flow of this cooled anti-freeze medium E, a temperature is controlled by a temperature sensor 38, and the food is uniformly frozen at a super rapid cooling rate.

A method for freezing foods according to the invention, as shown in Fig. 10, can freeze the food under a preferable condition within a short time from the direction of an arrow by jet-agitating the cooled anti-freeze medium E of an ethyl alcohol aqueous solution in the anti-freeze medium tank 2 by a jet-agitator 33 having a screw 21 for circulation and dipping the food, such as refreshable edible meat F in the cooled anti-freeze medium E.

In this case, a freezing tube path P, for uniformly freezing the refreshable edible meat F, is provided in the vertical direction along three directional inner surface walls 27, 28 and 29 of the anti-freeze medium tank 2, such as stainless steel coil tubes 3, 4 and 5 shown in Fig. 4, and two rows of the path P are provided at every inner wall surface. The anti-freeze medium E cooled by the freezing tube path P cools the food F by circulating and jetting from the direction of an arrow, as shown in Figs. 8, 9 and 10, by means of the jet

flow-agitator 33 of a jet screw pump type.

The jet flow-agitator 33, as shown in Figs. 5, 6, 8 and 9, has a jet tube 23 and a screw 21 fixed to a screw shaft 22 driven by a motor 45, and the anti-freeze medium E is circulated and jetted within the anti-freeze medium tank 2 from a jet inlet 24 of the jet tube 23 through a jet outlet 25 by rotation of the screw 21. The refreshable edible meat or the food is uniformly frozen in the cooled anti-freeze medium E by this jet. During this period, a temperature of the anti-freeze medium E is measured by the temperature sensor 38, and the temperature and dipping time are controlled by an electric control device 34. The jet tube 23 and the temperature sensor 38 are fixed to the anti-freeze medium tank 2, and the motor 45 is fixed to a supporting cylinder 46 fixed to the upper portion of the jet tube 23.

The jet outlet 25 of the jet tube 23 shown in Fig. 8 is curved and directed to the direction of a jetting flow, but the jet tube 23 shown in Fig. 9 guides the direction of a jet flow by a jet guiding tilting plate 26 provided at the bottom of the anti-freeze medium tank 2, so that either structure can be employed.

The temperature of an anti-freeze medium within the anti-freeze medium tank becomes equal by jet flow agitating of the jet agitator.

In order to uniformly freeze a food to be frozen within a short time, it is important to cause no unevenness of the temperature of an anti-freeze medium, and a uniform temperature of the anti-freeze medium within the freezer becomes possible by jet agitation by means of a jet screw pump type jet agitator.

Since the jet screw pump is made of stainless steel, it is excellent in durability and anti-corrosion, and very hygienic.

The temperature sensor 38, as shown in Figs. 2-4 and Fig. 6, is lowered from the jet agitator and the temperature sensor chamber 37 into the anti-freeze medium tank 2, and electrically connected to the control device 34, so as to make temperature control possible. The temperature change of the anti-freeze medium and the temperature of food to be frozen can be controlled by the temperature sensor.

An anti-freeze medium used in a secondary cold medium liquid is a colorless innoxious ethyl alcohol as a freezing liquid used as a food additive. Besides, use may be made of the liquid of sodium chloride, magnesium chloride, calcium chloride, glycerine, propylene glycol, ethylene glycol, and the like as an anti-freeze medium.

In the invention the whole food is wrapped for dipping into an anti-freeze medium at an ultralow temperature (i.e. -30 °C to -50 °C), so that it is possible to cool the food to be frozen from every direction and to uniformly freeze it without any unevenness. Moreover, the anti-freeze liquid medium is far better than air in thermal conductivity, so that it quickly passes through the maximum freezing point (-1 °C to -10 °C) of the food, and hence, quick freezing by liquid is effective so as to avoid the damage of slow freezing.

The freezing method of the invention can apply a super rapid freeze to the food at a comparative equalized temperature, so that the temperature difference between the outside and the center portion of a food is small, and thereby the osmotic pressure difference is small, and as a result cracks hardly produce on the surface of a food.

In the super rapid liquid freezing according to the present invention, no dripping during defrosting is made due to the super rapid freezing, and in case of freezing with the use of a retainer type stainless steel case for freezing adhered meat (to reform the meat as one by using small, broken pieces of meat by using this retainer.), it is preferable to recycle by repetitively using this case.

According to the invention, the frozen condition of meat or food is well, and any kind of defrosting process is available. Therefore, air, water and the like can be used.

A freezing method by the liquid cold medium according to the invention is extremely highly efficient in thermal conductivity, excellent in freezing condition, and as compared with other freezing methods in prior art, excellent in workability, freezing condition, equipment cost, total cost and the like.

An example of the refreshable food freezer according to the invention is further explained by referring to the accompanying drawings in detail.

As shown in Figs. 1-7, the refreshable food freezer of the invention is comprising by arranging stainless steel freezing coil tubes 3, 4 and 5 on three wall surfaces in two rows in the vertical direction along each inner wall surfaces 27, 28, 29 in three directions of the inner wall of an anti-freeze medium tank 2 filled with an anti-freeze medium (i.e. brine) E, providing a jet agitator 33 and a temperature sensor 38 along an inner wall surface in the other one direction, installing a food lifting device L at the upper portion of the anti-freeze medium tank 2, resiliently supporting a sealed insulating lid 8 by the lifting device L, air tightly freely closing and opening an opening portion 42 of the anti-freeze medium tank 2 by the sealed heat insulating lid 8, freely dipping in or taking out a food F from the anti-freeze medium tank 2, and uniformly freezing the food F at a super rapid cooling rate.

The anti-freeze medium tank 2 is a stainless steel tank filled with liquid cold medium and provided with

a heat insulating layer 31, the upper surface of which are provided a control device 34, a jet agitator and a temperature sensor chamber 37, and the rear surface of which is provided an oil pressure cylinder device chamber 13 of a lifting device L, and further provided with machinery facilities and electric devices such as a compressor unit C. A fixing leg stand 47 and a moving leg wheel 48 are provided at the bottom portion of the anti-freeze medium tank 2.

A pipeline of the freezer is explained by referring to Figs. 4, 5 and 7.

In Fig. 7, the compressor unit C has a freezing compressor 36, a strainer 39, a valve V and the like, and this compressor unit C and each freezing coil tube 3, 4, 5 are connected as a pipeline P by connecting through pressure valves 40, 41, and a valve V, a header H.

A food lifting device is explained by referring to Figs. 1 to 3.

The food lifting device L has a construction of dipping in and taking out a food F in the anti-freeze medium tank 2 by placing a basket 32 for housing food on a stainless steel perforated backing plate 6 of a lifting frame 7 lifted by an oil pressure cylinder device 16 mounted on an oil pressure cylinder device chamber 13, resiliently supporting a sealed heat insulating lid 8 by a pair of supporting arms 9, 9 fixed to the lifting frame 7, and freely opening and closing an opening portion 42 of the anti-freeze tank 2 by the sealed insulating lid 8.

The piston 17 is telescopically moved by the oil pressure cylinder device 16, the lifting frame lifts a basket 32 and a sealed heat insulating lid 8, placed the meat or the food 32 on the perforated backing plate 6 in the basket 32 of the lifting frame 7 and lowered it for dipping into the anti-freeze medium tank 2, and after completely freezing, lifts said meat or the food from the anti-freeze medium and takes it out from basket for defrosting. The lifting plate 12 moves along a guide shaft 20 fixed to the oil pressure cylinder device chamber 13. The oil pressure cylinder device 16 is provided with a telescopically movable cylinder 18 together with the piston 17. An opening portion 44 of the oil pressure cylinder device chamber 13 is formed as an opening for lifting the lifting frame 7.

The heat insulating lid 8 is fixed to a screw lever 10 penetrated through the supporting arm 9, and resiliently supported by interposing a spring 11 between the screw lever 10 and the supporting arm 9. A recess portion 43 of the heat insulating lid 8 is formed to pass the lifting frame 7 therethrough.

The food F is placed on the lifting device L, the lifting frame 7 is automatically lowered by one-touch operation of a switch button 35 of the control device 34, and at the same time, the opening portion 42 of the anti-freeze medium tank 2 is air tightly closed by the heat insulating lid 8 supported by a resilient device consisting of supporting arms 9, 9, screw lever 10 and spring 11, and freezing is started as a temperature change of the anti-freeze medium and a freezing temperature of the food are measured by the temperature sensor 38. The food to be frozen within the anti-freeze medium, after frozen at a constant temperature, is informed to be frozen by automatically raising the lifting frame 7, opening the opening portion 42 of the anti-freeze medium tank by the heat insulating lid 8 and simultaneously sounding a buzzer.

According to the invention, the lifting device can automatically be raised or lowered by one-touch operation and the basket 32 housed the food therein can smoothly and promptly be taken in and out because the whole machine is placed low and controlled by computer operator. Moreover, since the bottom space is wide, there are such characteristics that cleaning is easy, design is hygienic and the like.

The other applicable range of the invention than edible meat extends to sea food, edible bird, fruit to be frozen in refreshable state.

According to the method for freezing refreshable meats or other foods and the freezer of the invention, because of super rapid freezing, the freezing condition of frozen meat or other food is very well, the change of food cells and breakdown of systems are very few, and no dripping is caused at the time of defrosting. Therefore, it is not necessary to defrost in a special defroster, and the food is refreshed to the original fresh condition after defrosting, so that there is selected no defrosting means. Super rapid freezing does not break cells, so that conventional refrigeration and defrosting are available. When a raw food product is frozen, the product is refreshed to almost the original fresh condition after freezing and defrosting.

In the prior method, it takes 24 hours in a case of the prior cold air freezing, while according to the invention the freezing time can be shortened to only 30 minutes by ultrarapid freezing. Thus, the quality, freshness and taste of a food, particularly meat, can be frozen as they are in refreshable state, in a short time, defrosting is easy, and the invention can make a tremendous contribution to food processing industry.

Example

10.8 kg of beef round (15 cm in thickness) was quickly frozen from room temperature to -30°C ~ -50°C for 90 minutes. This frozen state according to the liquid freezing of the present invention is compared with that of nitrogen gas freezing. The time of nitrogen gas freezing requires 7-8 hours, while the freezing

time of present invention requires only 90 minutes.

In comparison with slow freezing which requires about 24 hours, the super rapid freezing according to the present invention only requires about 90 minutes, the invention is remarkably effective for lowering the costs.

	Freezing temperature	Freezing time	Result
Present invention	liquid -30 • C~-50 • C	1.5 hr-2 hr. (90 min-120 min)	-38 • C ~ -42 • C no drip flow
Nitrogen gas rapid freezing	gas/-100 • C	7 - 8 hr	dripping flow out even with packing after freezing, surface becomes dry by cracking larger dripping flow out even
Slow freezing	gas -30 • C~-40 • C	24 hr	with packing after freezing, surface becomes dry by cracking

The freshness and flavor of frozen foods after defrosting are most influenced by the cooling rate for freezing and dipping time.

Freezing foods depends on how fast the temperature at which foods freeze can be transferred through the food to be frozen. When the food is slowly frozen, frozen crystals of moisture content from the frozen item enlarge and cause the cell destruction. Therefore, at the time of defrosting, the food tends to produce drippings that include important components of the food, and as a result, contains less freshness and flavor. The liquid freezing method has solved these problems with three unique features.

Three great features of the super rapid liquid freezer lift type according to the present invention are as follows.

(1) Microcomputer loaded lift type automated system

A built-in microcomputer integrates the temperature change of the freezing liquid and the freezing point (temperature) of the food or meat to be frozen. The meat or food to be frozen is then loaded on a lift. The lift descends just by a touching movement at the same time that a flexible arm device closes the freezer lid and then the freezing process starts. After the food or meat to be frozen is frozen in the freezing liquid at a fixed temperature, the flexible arm device automatically opens the freezer lid while the lift ascends and a buzzer goes on to inform us of the completion of freezing.

(2) The jet screw pump mixes the freezing liquid inside the freezer to keep its temperature even.

The critical point to follow in freezing foods evenly in a short period of time is not to allow uneven temperature in the freezing liquid. The jet screw pump makes possible the even distribution of temperature by mixing the freezing liquid inside the freezer.

(3) High speed cooling of the freezing liquid with a special cooler

Two special coolers are equipped on the right and left sides inside the freezer using 3 rows and 10 levels of SVS : T : Stainless plate fins. After completing the freezing of the foods, they perform the rapid lowering of the freezing liquid in order to regain immediately its fixed temperature.

Differences in freezing methods between cold air freezing and liquid freezing according to the present invention are as follows.

In cold air freezing method

(1) Food is frozen by the flow of cold air at a super low temperature.
(2) Cold air does not easily reach the back part or side of the food directly, resulting in slow freezing.
(3) In requires at least more than 24 hours due to slow freezing.
(4) It requires more time to defrost as it tends to produce drippings.

In liquid freezing method

(1) Liquid at a super low temperature (-50°C) wraps the overall food, and thus can freeze it from every direction without causing unevenness.
(2) As liquid has a far better heat conductivity than air, it more quickly reaches the freezing point of good and can avoid slow freezing.
(3) As the liquid can accumulate 2,000 to 3,000 times more heater than the same amount of air does, it can steadily cope with a rapid load change, or cooling something with a high temperature.

The safety and merits of liquid freezer lift type according to the present invention is as follows.

(1) Freezing liquid medium is colorless and harmless in terms of food hygiene and is permitted by the Ministry of Welfare
(2) There is no need to touch directly the freezing liquid as operatings are automated.
(3) It is a very hygienic machine made of only stainless steel that has durability and corrosion resistance qualities
(4) Very few drippings after defrosting
(5) Because of super rapid freezing, the retainer can be recycled better than existing types in the prior art.
(6) Good freezing conditions only require normal defrosting methods
(7) The super rapid liquid freezer requires in only 30~120 minutes, comparing with 24 hours usually required in the prior art.

Claims

1. A method for freezing foods comprising the steps of uniformly cooling an anti-freeze of an aqueous solution of ethyl alcohol as a secondary cold medium by a stainless steel freezing coil tube within a sealed anti-freeze medium tank, jet-agitating this cooled anti-freezing medium by a jet-agitator, dipping foods in an agitating jet flow of this cooled anti-freeze medium, controlling a temperature between -30°C and -50°C by a temperature sensor, and uniformly freezing the food at a super high rapid freezing rate.

2. A food freezer comprising an anti-freeze medium tank, stainless steel freezing coil tubes disposed in the vertical direction along the three inner wall surface of said anti-freeze medium tank filled with an anti-freeze medium, a jet-agitator and a temperature sensor provided along the other inner wall surface, a food lifting device provided at the upper portion of the anti-freeze medium tank, a sealed insulating lid resiliently supported by the lifting device, an opening portion of the anti-freeze medium tank being freely air tightly closed or opened by the heat insulating lid, wherein the food being is freely dipped in or out of the anti-freeze medium tank and uniformly frozen at a super rapid cooling rate for freezing.

3. A method or freezing foods as defined in claim 1, wherein the foods is vacuum packing or a deaeration packing or rapping into synthetic resin film and the packed food is dipped into a cooled anti-freezing medium of said anti-freezing medium tank.

4. A method for freezing foods as defined in claim 1, wherein the foods is uniformly frozen at a super rapid freezing rate in which a super rapid freezing rate is 25~30 minutes for passing a maximum freezing crystallization zone.

5. A food freezer as claimed in claim 2, wherein a jet tube is provided with a jet inlet and a jet outlet of an anti-freeze medium, a jet flow guiding titling plate is provided at the jet outlet with the use of a jet screw pump type jet agitator provided with a screw in the jet tube, and the anti-freeze medium is jet agitated.

6. A food freezer as claimed in claim 2, wherein a basket for housing food is placed on a stainless steel perforated backing plate of a lifting frame lifting by an oil pressure cylinder device, the heat insulating lid is resiliently supported by a supporting arm fixed to the lifting frame, the opening portion of the anti-freeze medium tank is freely air tightly closed or opened by the heat insulting lid, and a food lifting device is provided for freely dipping the food in or out of the anti-freeze medium tank.

FIG_1

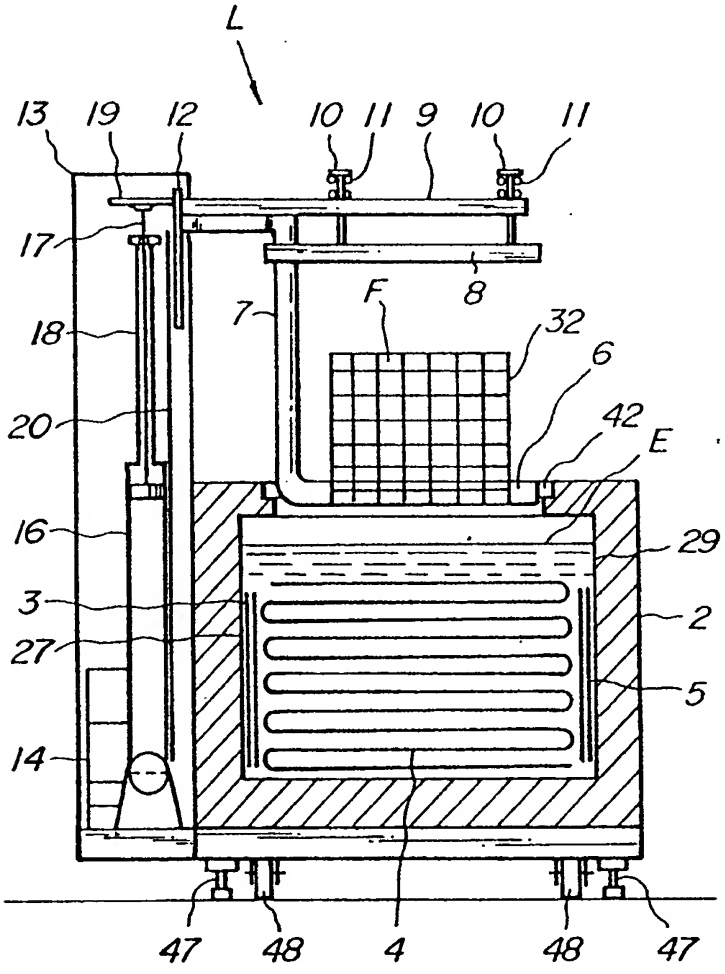
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FIG_2

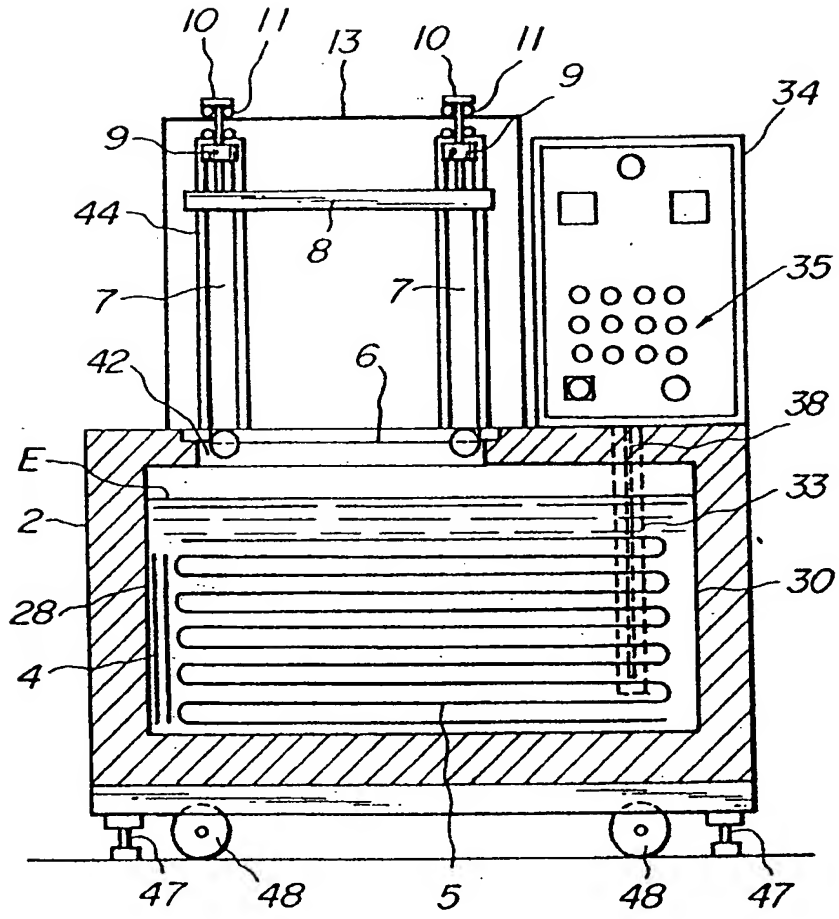


FIG_3

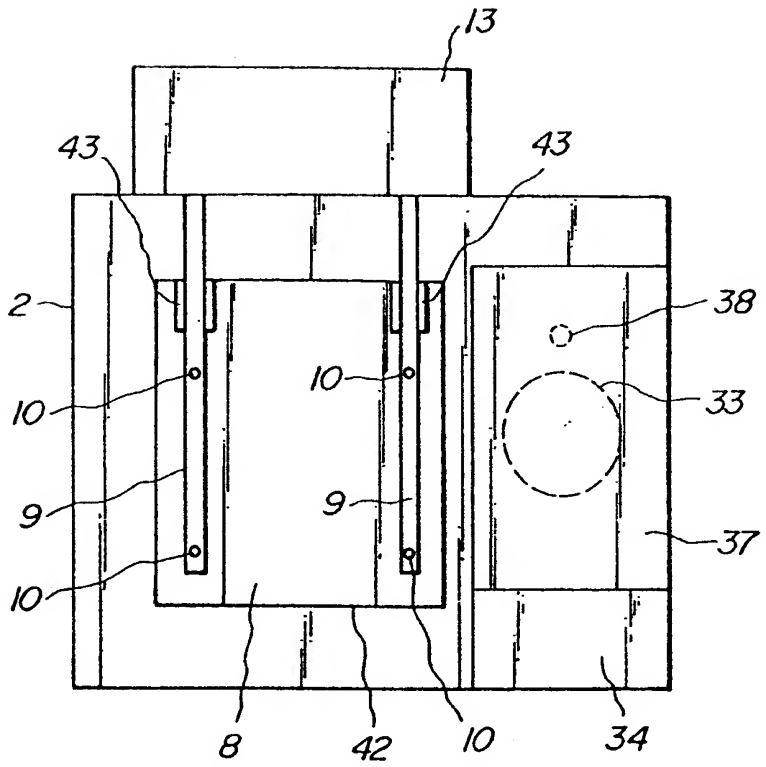


FIG_4

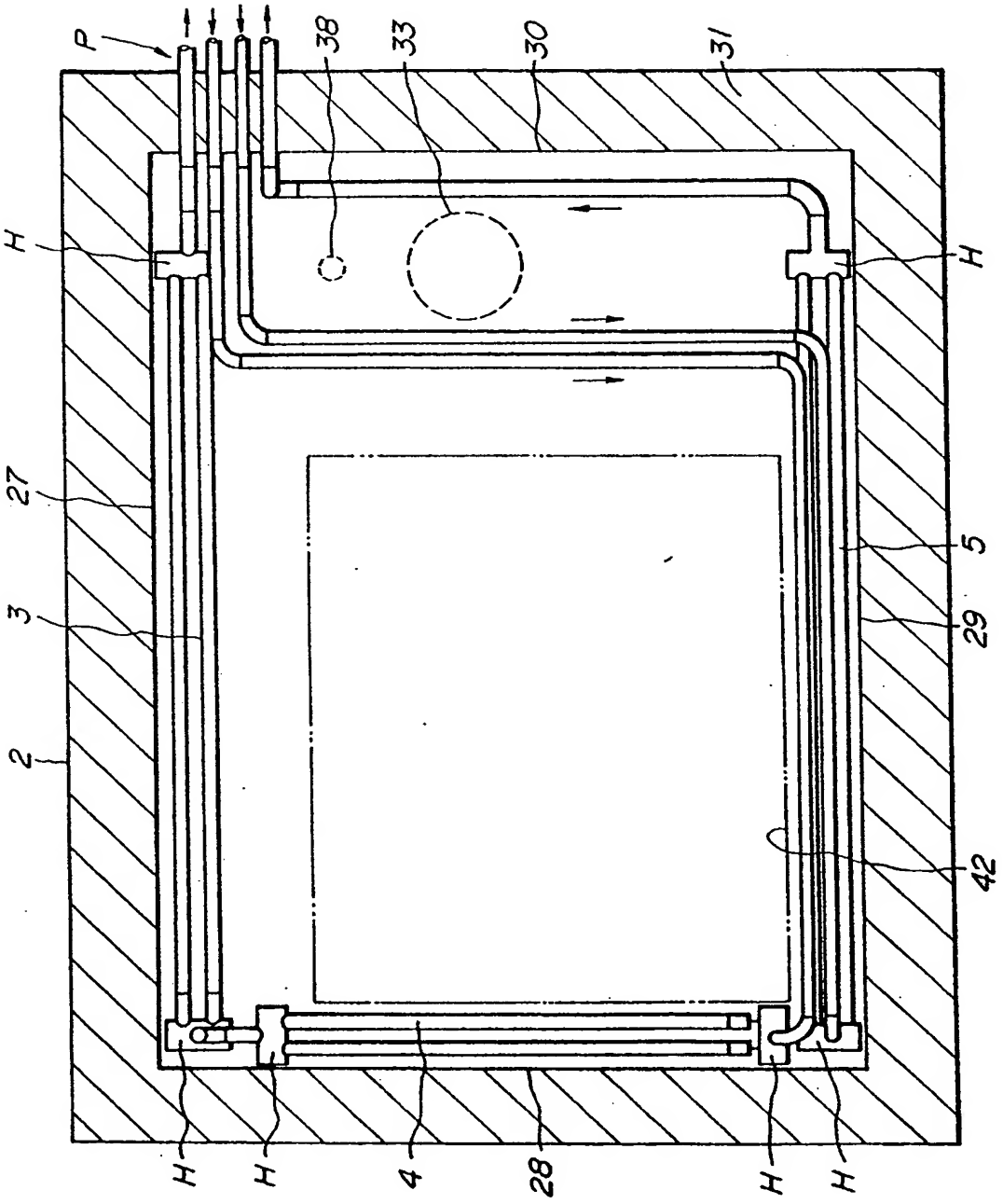


FIG. 5

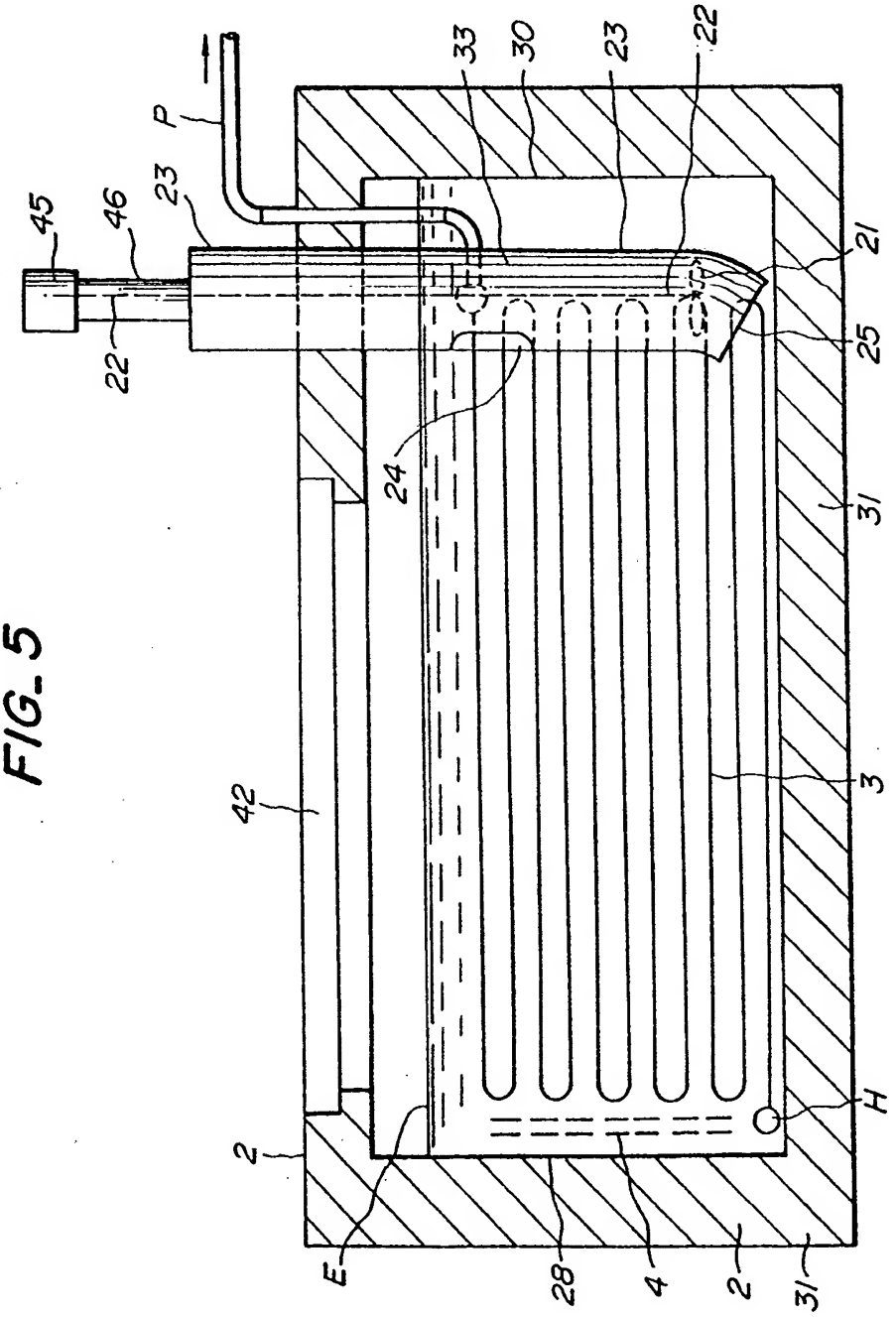


FIG_6

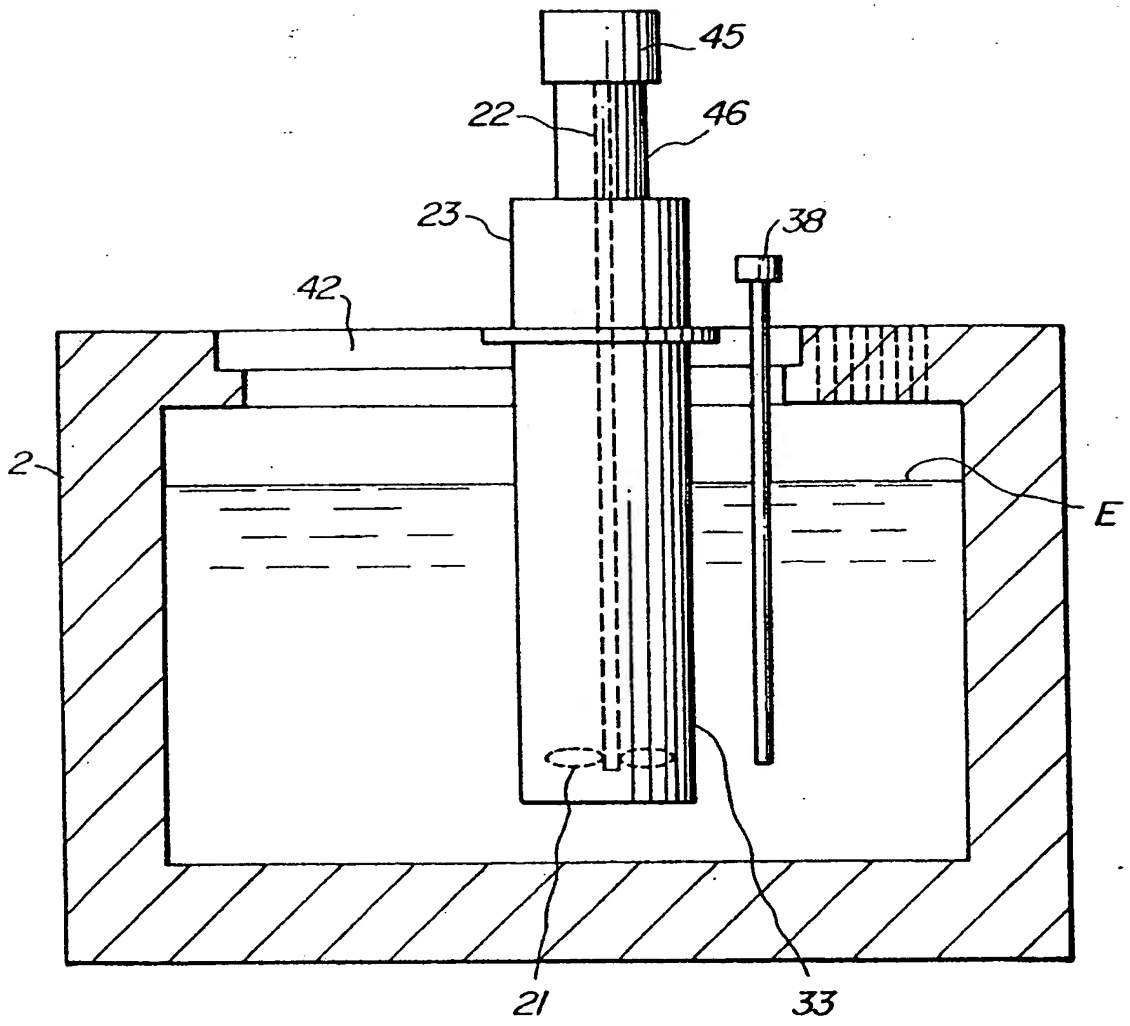


FIG_7

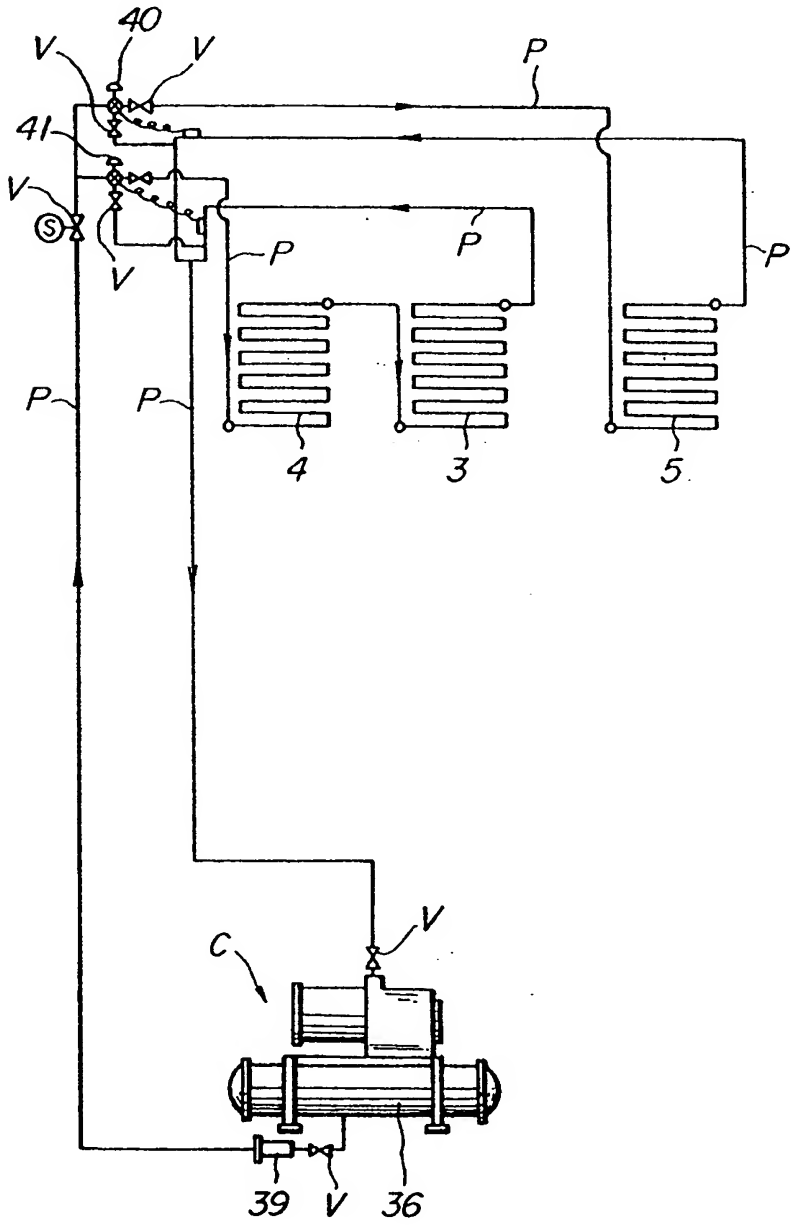


FIG_8

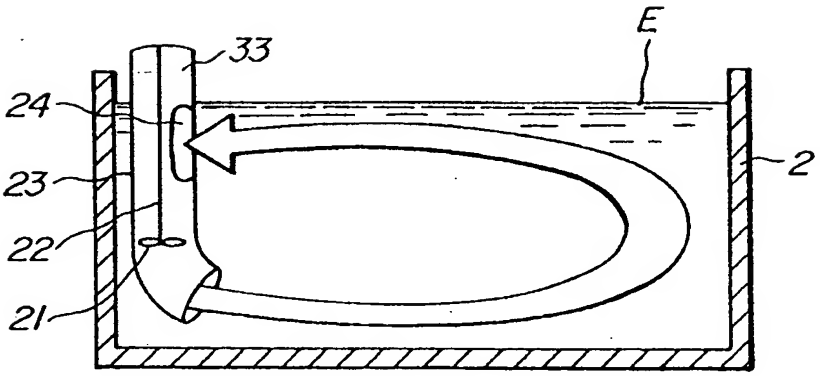


FIG_9

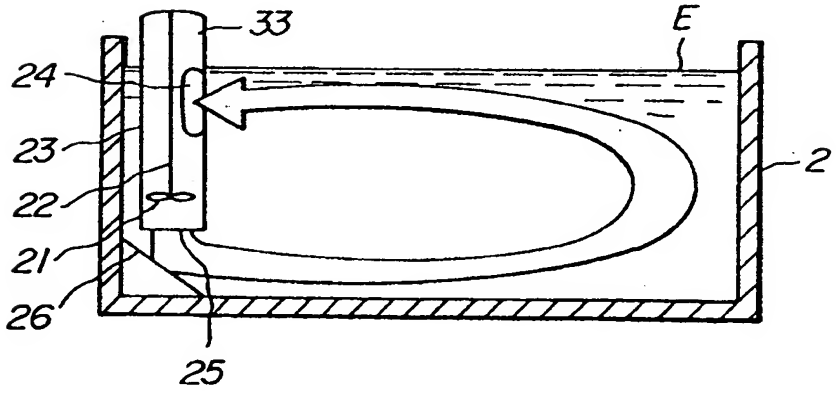


FIG_10

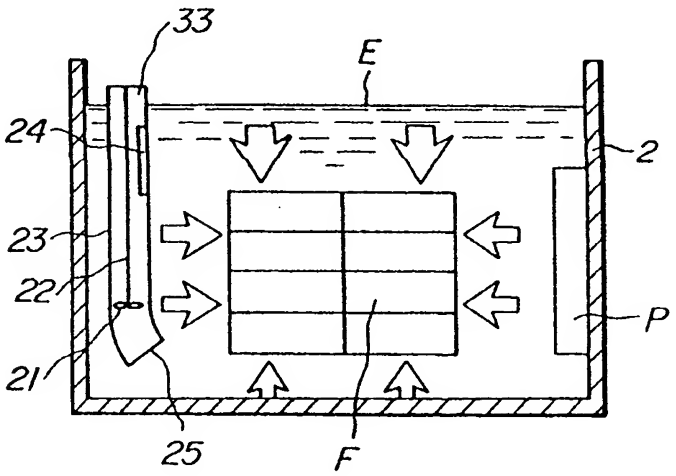
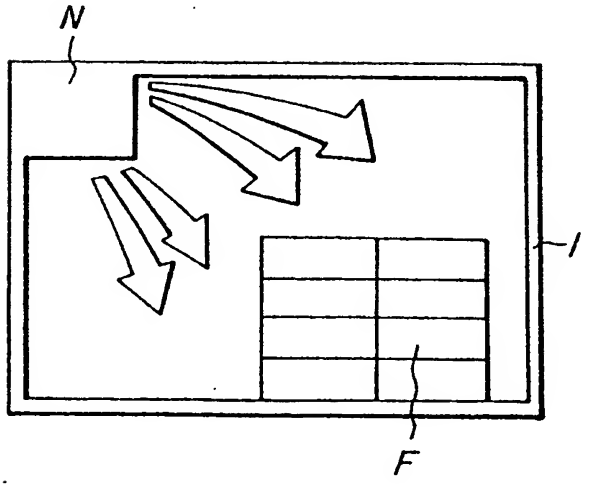


FIG_11



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EUROPEAN SEARCH REPORT

Application Number

EP 91 30 0541

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
X	EP-A-0 174 170 (CASTELTON INC) * the whole document * *	1	A 23 L 3/36 F 25 D 17/02
Y		2,3,4,6	
Y	FR-A-2 562 217 (MOREL) * claims * *	3,4	
Y	FR-A-2 176 551 (RIGAL ET AL) * page 2, line 16 - page 3, line 29; claims; figure * *	2,6	
X	US-A-4 715 195 (KUCZA) * the whole document * *	1,3	
A	WO-A-8 803 251 (PROVEST ET AL.) * claims; figure 1 * *	2,6	

TECHNICAL FIELDS SEARCHED (Int. Cl.5)
A 23 L F 25 D

The present search report has been drawn up for all claims

Place of search	Date of completion of search	Examiner
The Hague	16 January 92	LEPRETRE F.G.M.J.

CATEGORY OF CITED DOCUMENTS

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